Novices' Corner

Fly-cutting

FLY-CUTTING is usually carried out with a single-point tool mounted in a holder for gripping in the lathe mandrel chuck, or the tool may be carried in an arbor running between the lathe centres, or, again, a cutter frame attached to the lathe saddle may be used for this purpose.

Although the fly-cutting tool is not primarily intended for removing large amounts of metal, it has, nevertheless, the advantages that it is easily and cheaply made of high-speed steel to any required shape, and when blunted it can be readily resharpened by straightforward grinding and oilstoning.

Milling cutters, on the other hand, are relatively costly and need special grinding equipment for resharpening. Again, by using a fly-cutter, sharpened on an oilstone, a very tine, chatter-free finish can without difficulty be given to the work, whereas in light lathes a good finish is not always obtained with the ordinary milling cutter, especially when the teeth have become slightly blunted.

Making a Fly-Cutter

A simple form of fly-cutter head for mounting in the self-centring chuck is illustrated in Fig. I.

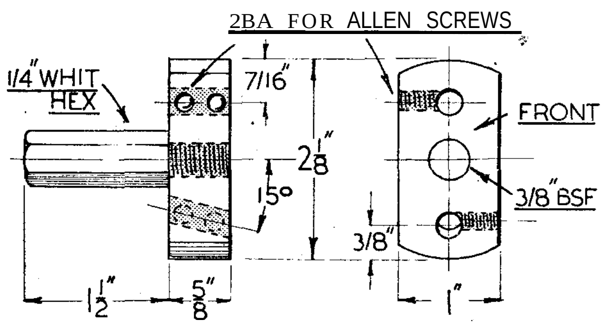

Fig. 2. Showing the details of the fly-cutter parts

The self-centring chuck can be used for this purpose, as with a single-point tool there is, of course, no need for the holder to be truly centred ; but if a milling cutter does not run truly, cutting will be intermittent and the bulk of the work will fall on a few teeth only ; in fact, an eccentrically mounted milling cutter will behave rather like a fly-cutter, but has none of its advantages.

The head illustrated was made from a short length of 5/8 in. x 1 in. mild-steel and is intended to carry cutter-bits of 1/4 in. diameter high-speed

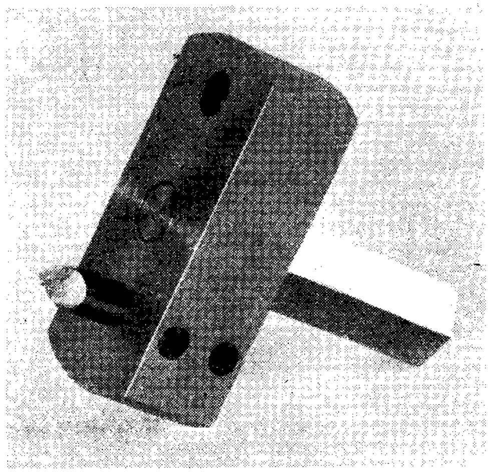

Fig. I. An easily made fly-cutter with two tool positions

steel. Two tool housings are provided ; the axial mounting of the tool will serve for all ordinary facing work, but when cutting against an overhanging shoulder the tool is mounted obliquely in the second tool housing.

This obliquely-placed hole is best drilled at the outset and before the bar is cut to the finished length. If the work is set at an angle of 15 deg. for drilling this hole, the drill will be deflected and the drilling will be out of line even if the drill does not break in the process. To give guidance to the drill point at starting, a hole of 1/4 in. diameter at its mouth is first drilled at the back of the part with a centre drill and with the work held horizontally in the machine vice. Next, a drilling guide, made of mild-steel 1/8 in. in thickness, is clamped to the work, as shown in the illustration. The guide is positioned with its 1/4in. diameter guide hole exactly over the centre hole already drilled in the work. When the work has been set in the vice to an angle of 15 deg., a letter D drill is put right through, and the drilled hole is then finished to size with a 1/4 in. diameter reamer. Work the reamer in carefully, turning it always in a forward direction and at the same time applying plenty of cutting oil. The second or axial tool housing can now be drilled and reamed, and the central hole for mounting the shank is drilled with a letter P or a 21/64 in. diameter drill and then tapped 1/8 in. B.S.F.

The shank fitted to the cutter head is shown made from a piece of 1/4 in. Whitworth nut-size hexagon bar, as this gives the finished tool a secure mounting in the three-jaw chuck. If preferred, a round shank can be used, and a tommy hole is drilled across for screwing the head into place ; in addition, the backward projecting end of the cutter-bit then abuts against one of the chuck jaws and so prevents slipping. When hexagonal material is used, the shoulder formed on the shank should be machined so that the head, when screwed firmly home, lies with the tool housings in line with the flats of the hexagon ; this allows the tool shanks to pass between the chuck jaws when the fly-cutter is in use. The curved surfaces at the two ends of the head are machined by gripping the shank in the chuck and

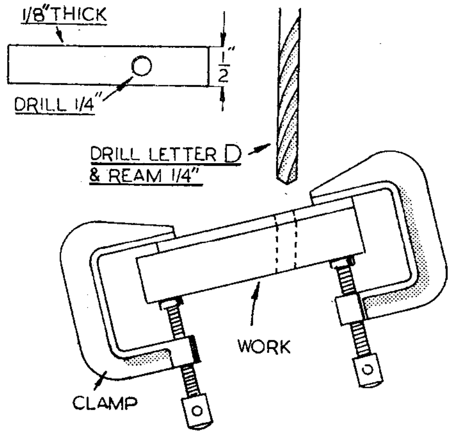

Fig.* 3. *Showing the method of using the drill guide to form the oblique tool housing

then using a knife tool to take light cuts until an even finish is obtained. To complete the work, the Allen grub-screws for securing the tools are put in and, after the front and back faces of the head have been finish turned, the side surfaces of the head and the shank are filed to a good finish. It should be noted that the clamp-screws are

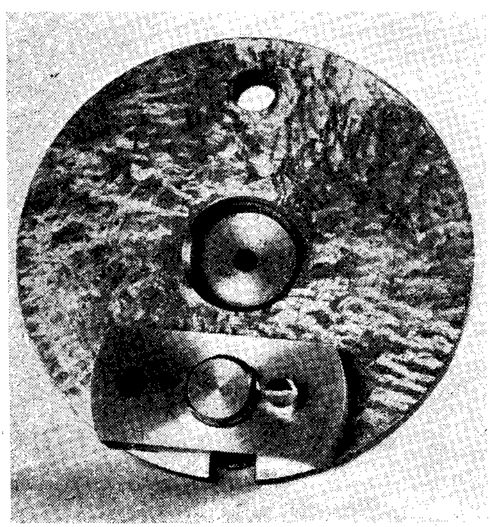

Fig.* 4. *The fly-cutter head attached to the lathe driver plate

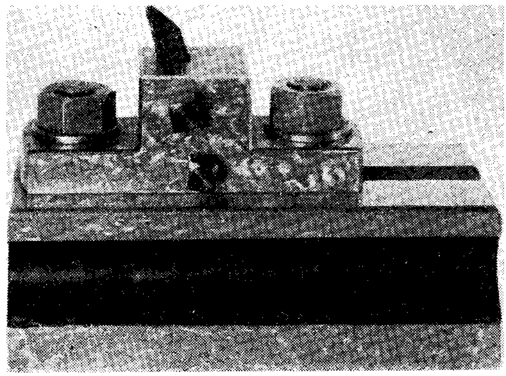

Fig. 5. A fly-cutting attachment for large work

fitted so that the cutting pressure forces the tool against its housing and not against the screws themselves. The tool just described, when mounted in the self-centring chuck, will cut on a fixed radius of about 5/8 in., but to machine a larger area the head is unscrewed from the shank and then attached either to the lathe driver-plate or to the faceplate with a single clamp-bolt, as is shown in Fig. 4.

Other **Forms of Fly-Cutters**

Another way of mounting a tool to machine on an extended radius is to use a device like that illustrated in Fig. 5. Here, a cast base with a

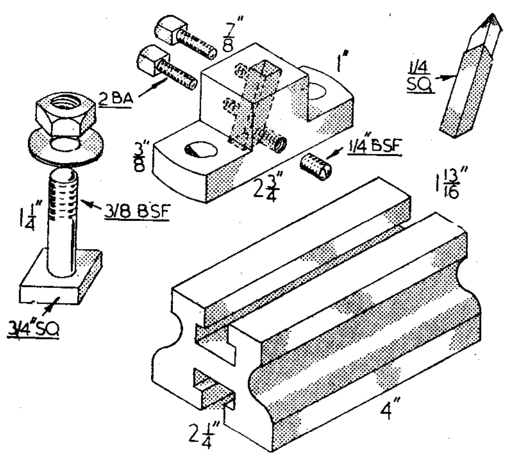

Fig. 6. Constructional details of the large fly-cutter

T-slot at back and front is bolted to the lathe faceplate, and the toolholder can then be set in the front T-slot to any radius required, provided that there is space enough in the lathe bed gap. A square tool is fitted and, as it is a difficult matter to file a square hole with its sides flat, a grub-screw is inserted at the far end of the housing so that the tool can obtain an even bearing and will not tend to rock when secured by the clamping-screws.

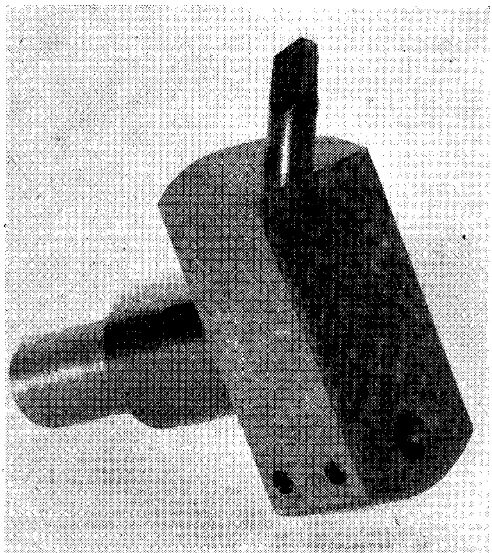

Fig. 7. A fly-cutter for use in a large lathe

The fly-cutter illustrated in Fig. 7 was made for use in a large lathe and is capable of carrying out quite heavy machining.

The tool-bits fitted are 3/8 in. in diameter and, as before, both axial and oblique housings are provided. As will be seen, the cutter when set obliquely lies at a more obtuse angle than in the previous tools ; this enables the tool housing to be more easily drilled, as a flat drilling surface can be filed without materially reducing the length of the tool housing. As this tool was used for taking heavy cuts, a flat was ground on the under side of the tool to give a bearing for the clamp-screws and prevent the cutter's turning. As previously mentioned, it is advisable to fit the clamp-screws so that they hold the tool-bit against a solid face, but in this instance the clamping-screws have been put in on the reverse side. This means that the clamping area to resist the cutting thrust is limited to the distance between the two screws, instead of being for the full length of the housing ; moreover, the pressure then falls on the screw threads and not on the solid metal of the head.

Cutter-bits

The tools carried in the fly-cutter head are formed on the same principles as are used for grinding lathe tools ; that is to say, adequate clearances must be given at the cutting edges, and the amount of rake will depend on the material being machined. To obtain a really good finish when fly-cutting a flat surface, the rounded tip of the tool should be honed on an oilstone until the cutting edge is made perfectly smooth and regular.

The speed at which these cutters should be run is, again, in accordance with ordinary turning practice, and it matters little in adjusting the cutting speed that, here, the work is stationary and the tool is revolving. For example, if, when machining mild-steel, a high-speed steel cutter revolves on a radius of 1 in., the tool will travel approximately 1/2 ft. at each revolution, and a cutting speed of 100 ft. a minute will, therefore, be obtained with the lathe set to run at 200 revs a minute.

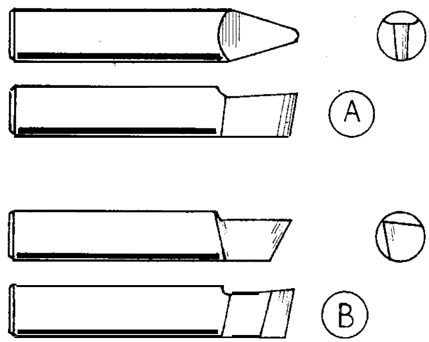

Fig. 8. Fly-cutter tools. A, a front tool ; B, a tool for undercutting a shoulder

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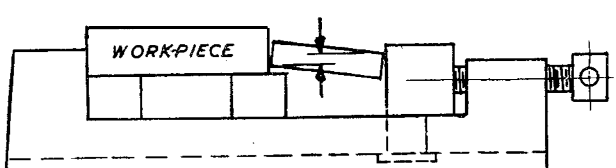
VICE WORK

HERE is a tip to those who find difficulty in maintaining the work-piece close to the parallels when placed in a vice.

A square-edged strip is interposed between the piece and the loose jaw, as shown. When the jaw is tightened the canting action forces the piece downwards.



The secret is to have the contact edge of the strip which touches the work lower than thar which is against the loose jaw.—H. T. TROTMAN.